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Forest Research Notes

Northeastern Forest Experiment Station

FOREST SERVICE, U.S. DEPT. OF AGRICULTURE, 102 MOTORS AVENUE, UPPER DARBY, PA.

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SEASONAL GROWTH IN WHITE PINE SEEDLINGS FROM DIFFERENT PROVENANCES

The Northeastern Forest Experiment Station, in cooperation with other experiment stations in the United States and Canada, began a range-wide provenance test of eastern white pine (Pinus strobus L.) in 1955. Seed was collected from 31 different locations in 17 states and 4 Canadian provinces. In most places collections were made from 10 trees at each location. The seed from individual trees was kept separate.

Twenty-one of the test provenance seedlots (table 1) were grown at the New Jersey state nursery at Washington Crossing, N. J. Seed for this test was sown in the fall of 1956. Each mother-tree lot occupied 1 bed-foot (1 foot by 3 feet). The seedlings were thinned to about 35 per square foot in July 1957.

During the 1959 growing season periodic measurements of height growth were made on selected seedlings of this test. Three mother-tree lots were randomly selected within each provenance and five seedlings were chosen from each lot. Thus 15 seedlings of each provenance were measured. Bud swelling and elongation started in all provenances on or about April 17. Height growth was measured thereafter at approximately weekly intervals until July 13. Measurements were made with a steel millimeter tape from a fixed point, usually the axil of a lateral bud or branch.

Variables that were studied included: (1) duration of the growth period up to the base of the terminal bud; (2) total growth from the tip of the 1958 terminal bud to the base of the 1959 terminal; (3) total growth from the tip of the 1958 terminal bud to the tip of the 1959 terminal or lammas shoot; and (4) the percentage of tip-to-base growth completed by May 18. These data are given in table 2.

Table 1.--Description of eastern white pine seed sources

Seedlot designation	State or province	County	Latitude	Length of growing season*
				(Days)
1GA	Georgia	Union	34°46'	205
2NC	North Carolina	Transylvania	35°14'	170
3TE	Tennessee	Greene	36°00'	187
4MD	Maryland	Garrett	39°24'	133
5WV	West Virginia	Greenbrier	38°00'	150
6PA	Pennsylvania	Monroe	41°05'	127
7PA	Pennsylvania	Monroe	40°55'	144
8PA	Pennsylvania	Clearfield	40°46'	139
9PA	Pennsylvania	Clearfield	40°46'	139
10NY	New York	Ulster	42°00'	160
11NY	New York	Ulster	42°05'	160
12NY	New York	Franklin	44°25'	99
13MA	Massachusetts	Worcester	42°30'	153
14ME	Maine	Penobscot	44°51'	142
15IA	Iowa	Allamakee	43°18'	149
16OH	Ohio	Ashland	40°45'	157
18WI	Wisconsin	Forest	45°40'	123
19MN	Minnesota	Cass	47°25'	120
20NS	Nova Scotia	Lunenburg	44°25'	(**)
21NB	New Brunswick	Sunbury	45°56'	(**)
22QU	Quebec	Quebec	46°29'	(**)

*Data from Climate and Man, U.S. Dept. Agr. Yearbook, 1941.

**No data available for Canadian sources.

Table 2.--Growth data for eastern white pine provenances

Seedlot* designation	Duration of growth	Tip-to-base growth completed by May 18	Tip-to-base growth	Tip-to-tip growth
	Days	Percent	Mm.	Mm.
1GA	51.5	59.8	249	271
2NC	47.8	63.8	209	225
3TE	48.5	67.9	202	246
5WV	46.9	70.0	190	204
4MD	46.9	70.7	208	224
16OH	47.3	68.5	207	222
8PA	44.5	77.9	158	171
9PA	44.5	71.7	206	223
7PA	45.0	72.9	159	173
6PA	45.0	72.1	181	196
10NY	43.1	77.6	163	177
11NY	44.5	78.1	198	215
13MA	45.0	77.7	196	214
15IA	45.0	73.7	189	203
12NY	42.2	85.4	145	161
20NS	37.4	91.4	126	161
14ME	43.1	79.9	179	197
18WI	39.9	86.6	116	129
21NB	37.1	92.7	123	144
22QU	36.6	95.3	92	111
19MN	37.5	90.3	106	128

*Seedlots are listed here in order of increasing latitude.

Active terminal height growth continued until June 8 in the Georgia and North Carolina seedlots whereas the Canadian seedlings and some tree-lots from Minnesota and Wisconsin had ceased their initial elongation by May 25. The trees were not measured between July 13 and August 20, during which time the terminal buds were set and all lammas growth took place. Thirty-four seedlings exhibited lammas growth in 1958 and 43 trees showed this second growth flush during 1959. Seventeen trees had lammas growth in the terminals in both years. Although there was a tendency for seedlots of southern origin to have a higher percentage of seedlings with lammas growth, none of the North Carolina trees showed this characteristic, whereas seven of the Nova Scotia seedlings had a second growth flush in 1959.

The data for the four growth variables were subjected to analysis of variance and in all cases highly significant differences were found between provenances. Furthermore, when the four growth variables were correlated with latitude and growing season of origin, all correlations were highly significant. Thus a seedlot from the southern part of the range in an area with a relatively long frost-free season

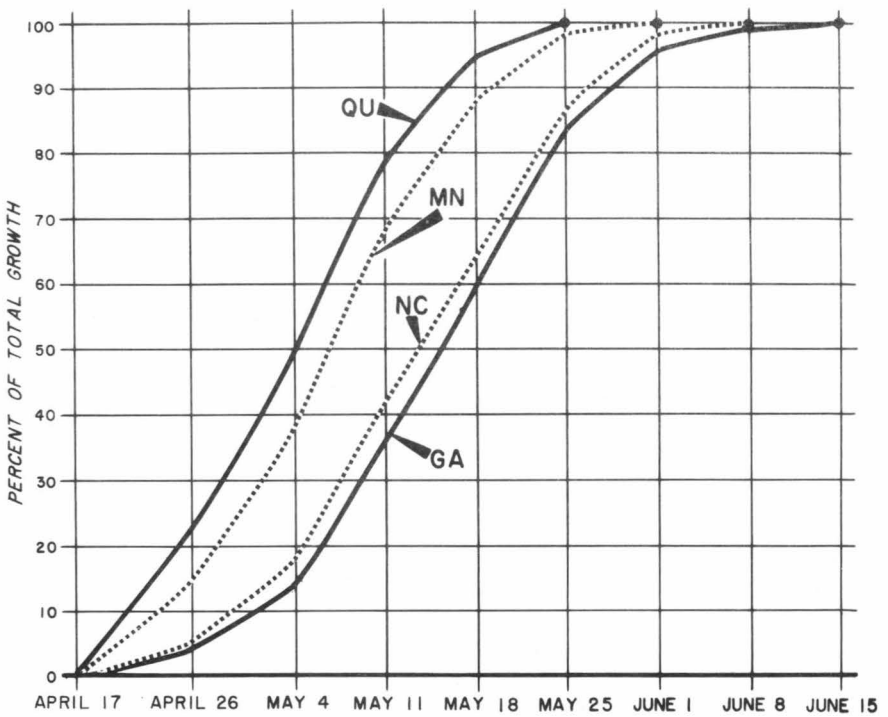

Figure 1.--*Cumulative tip-to-base growth for two northern and two southern seed sources of eastern white pine, at approximately weekly intervals.*

grew for a longer period of time in the nursery and also to a greater height than seedlings of northern origin. Superiority in height growth of southern sources has also been shown in similar nursery tests in New York and Maryland. A comparison of the seasonal growth pattern for two northern and two southern seed sources is given in figure 1.

The variation between provenances in length of growth period, and in percentage of tip-to-base growth completed by May 18, appeared to be of a continuous nature when the data were analyzed by a multiple range test (a test designed to permit comparisons of means from different points in the array). The total growth figures, on the other hand, showed marked discontinuities. However, since only 1 year's growth was measured and the variation between mother trees within provenances was large, these discontinuities may have no biological significance.

The fact that active terminal growth in all provenances had stopped prior to the longest day of the year suggests that the duration and cessation of height growth in Pinus strobus is not under direct photoperiodic control. Seedlings of southern origin may be able to utilize a greater portion of the growing season in northern latitudes than those of northern origin and still remain capable of hardening off in time to escape damage by early frost. The question whether this juvenile superiority of southern stock will continue throughout the life of the tree will be answered by future observations on the many test plantations now being established.

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